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Status of the Coupled Core-Edge Tokamak Transport Simulations with the *Corsica 2* Code

A. Tarditi, R. H. Cohen, J. A. Crotinger, N. Mattor, G. D. Porter, T. D. Rognlien, G. R. Smith

Lawrence Livermore National Laboratory, Livermore, CA 94550 (USA)

Corsica 2 [1] is a transport core-edge code for tokamak plasmas based on the iterative coupling of the 2D axisymmetric edge/SOL code *UEDGE* with *Corsica 1*, a 1D radial (in toroidal flux coordinates) core transport code (that includes the free boundary MHD equilibrium module *TEQ*, [2]).

The core profiles are joined to the flux-surface averaged profiles from the 2D code sufficiently inside the magnetic separatrix, at a flux surface on which the quantities are approximately constant.

The model allows the core-edge coupling of multiple ion densities while retaining a single temperature (corresponding to the equilibration value) for the all ion species. In the present implementation the code can couple up to six fields: deuterium density (the electron density is determined by imposing quasi-neutrality) electron and ion temperatures, neutral gas density, (thermal) alpha particles and the toroidal angular momentum.

As all the operations involving the coupled fields are done in vector notation, the code can be customized straightforwardly by adding or changing a coupled variable (*e.g.* an impurity species).

Corsica 2 has been applied primarily to the modeling the DIII-D tokamak, with close interaction with the experimentalist group. Simulations of C-mod and JET discharges have been also initiated.

This paper will review the current simulation studies and efforts in progress with *Corsica 2* on some important physics issues that involve a core-edge interaction like L-H transition, neutral and impurity core penetration, helium ash transport (for ignited ITER scenarios with coupled thermal alphas) and density limit.

In particular the modeling of the L-H transition is based on a previously reported simulation experiment with *Corsica 2* [3] involving the coupling of a single ion species (deuterium) and of the two (electron and ion) temperatures. The model features now an improved self-consistent character: the drop of the transport coefficients in the H mode is driven by the change in the turbulence energy level which in turn is triggered by raising the power in the core (via neutral beams injection). This scheme (derived from [4]) models an L-H transition pattern by means of a set of two coupled equations for the turbulence energy and the toroidal angular momentum and with the proper choice of few adjustable parameters.

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[3] A. Tarditi, *et al.*, to be published on *Contrib. Plasma Phys.* (1996)
[4] P. H. Diamond *et al.*, *Phys. Rev. Lett.*, 72, 2565 (1994)

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